

627.41(73) RIVERS AND FLOODS

By H. C. FRANKENFIELD

With high pressure predominating over the middle Atlantic Ocean and low pressure to the westward as far as the Rocky Mountains during the last days of February and the first three weeks of March, there was naturally an abundance of rain. At times the low pressure area extended from Canada to Mexico and the Gulf, and from the Ohio Valley southward the resulting rains were torrential.

Between February 26 and March 23 there were four distinct periods of heavy rain as follows: February 26-28, March 4-5, March 12-15, and March 21-23. The rains that fell during the first three periods were very heavy over Georgia, Alabama, northwest Florida, and southern Mississippi, those of the third period exceptionally so, while the rains of the fourth period were heaviest over the drainage basins of the Cumberland, Tennessee, and upper Kentucky Rivers. During the third period the average rainfall over the upper basin of the Altamaha River of Georgia approximated 4.7 inches, over the basin of the Flint River of Georgia 6.3 inches, over the basin of the Chattahoochee River of Georgia and Alabama 9.6 inches, over the basins of the Choctawhatchee and Conecuh Rivers of Alabama and northwest Florida 14.8 inches, over the basin of the Mobile River of Alabama 7 inches, and over the Pascagoula and Pearl River Basins of Mississippi 6 inches. At Elba, Ala., in the drainage of the Choctawhatchee River the rainfall from March 12 to 15 amounted to 29.60 inches, partly estimated, however, as the rain-gage was carried away by the flood waters on March 14 after a measurement of 14 inches for the period from 8 a. m. to 4 p. m. The total estimated amount for the 24 hours ending at 8 a. m. March 15 was 20 inches. At River Falls, Ala., in the drainage of the Conecuh River, the rainfall for the same period was 20.23 inches, of which 11.20 inches occurred during the 24 hours ending at 8 a. m. March 15. This amount was also partly estimated, as the gage was carried away at 5 p. m., March 14. At Brewton, Ala., in the same basin, the rainfall during this period was 16.26 inches. These were the heaviest rains reported, with the basin of the Chattahoochee River not far behind.

The following table gives the approximate rainfall for the four periods previously mentioned. There were some lesser falls between the periods, but none of sufficient consequence to materially affect the flood conditions:

TABLE 1.—Period rainfall, February 26 to March 23, 1929

Drainage basin	Feb. 26-28	Mar. 4-5	Mar. 13-15	Mar. 21-23	Total
James.....	2.16	1.85	1.07	0.33	5.41
North Carolina.....	2.15	2.07	1.22	1.15	6.59
Peebles.....	1.23	1.38	1.88	1.23	5.72
Santee.....	2.97	2.52	1.68	1.90	9.07
Savannah.....	4.57	4.42	2.78	2.66	14.43
Altamaha, Ocmulgee, and Oconee.....	4.16	3.98	4.70	1.70	14.54
Flint.....	4.46	3.30	6.34	0.81	14.91
Chattahoochee.....	5.47	4.37	9.64	1.40	20.88
Apalachicola (proper).....	0.71	0.67	3.10	—	4.48
Choctawhatchee.....	4.10	3.00	14.81	1.16	21.91
Conecuh.....	5.30	3.15	15.00	0.70	23.45
Alabama.....	4.39	3.40	6.60	3.21	17.60
Tombigbee.....	2.91	1.47	7.32	4.46	16.16
Pearl and Pascagoula.....	2.70	1.84	6.04	2.33	12.91
Cumberland.....	1.49	1.45	1.38	4.76	9.08
Tennessee.....	2.28	1.42	2.55	3.89	10.14
Lake Erie.....	—	0.08	1.82	0.32	2.22
Lake Huron.....	—	—	0.61	0.06	0.67
Lake Michigan.....	—	—	1.19	0.18	1.37
Yazoo.....	1.69	1.11	2.22	4.14	9.16

The briefest glance at the above table will disclose the regions of maximum floods—Georgia, Alabama, and

northwest Florida. The heavy rains of February 26-28 soon brought all their rivers to flood, and the climax followed the enormous rainfalls of the third period, March 13-15. The rains of the fourth period, six days after, were the lightest of the four periods and were instrumental mainly in prolonging the prevailing high stages without creating new crests.

Choctawhatchee and Conecuh Rivers.—By far the greatest and most destructive of the floods were those in the Choctawhatchee and Conecuh-Escambia Systems of Alabama and Florida. They attained heights far beyond any previous records, and it is to be regretted that their description must be brief. However, lack of space permits no alternative. As a matter of fact any description would fail to do justice to the actual facts, as the floods so far exceeded the previous great floods of 1861 and 1916 that intelligent comparison would be impossible, as the differences in crest stages would not afford a true measure of the differences in conditions.

Three periods of heavy rains during the month of February caused either bankful stages or more, and the saturated soil afforded an excellent foundation for the disasters to come.

The town of Elba, Ala., on the Pea River, an important tributary of the Choctawhatchee, was inundated to a considerable depth, 10 feet or more in places, as were the towns of Geneva, Ala., and Caryville, Fla., on the main stream, while the town of Westville opposite Caryville was partially overflowed. The breaking of a hydroelectric power dam on the Pea River on March 14 increased the stage at Elba, and probably to some extent the Choctawhatchee below Geneva.

The floods in the Conecuh-Escambia River were equally disastrous, and the waters covered the towns of River Falls, Brewton, Pollard, and Flomaton, Ala., and considerable portions of the towns of Century, Bluff Springs, McDavid, Pine Barren, and Molino, Fla.

Every industry and every activity, both urban and rural, suffered heavily. Traffic on railroads and highways was suspended and river navigation interrupted on the Choctawhatchee River below Geneva, Ala.

Owing to the unprecedentedly high stages reached by the flood waters, the loss and damage account was very large. The total reported was \$4,746,500, divided as follows: Tangible property, \$3,713,500; livestock and other movable property, \$100,000; suspension of business, \$1,000,000. The reported value of property saved through the flood warnings was only \$31,000, as the rivers were so high that protective measures were useless. No human lives were lost.

Flood warning service on the Choctawhatchee and Conecuh Rivers was inaugurated only about five months ago, and with little or no previous data to serve as a basis, the work of forecasting the flood stages was attended by much difficulty, which was enhanced by numerous delays in telegraph service that were to be expected under the circumstances. Nevertheless the warnings, which were both frequent and timely, were very satisfactory as a whole, and were instrumental in saving many human lives and much property. In the dissemination of warnings the Weather Bureau was greatly assisted by the press, the Louisville & Nashville Railroad, and radio broadcasting station WCOA. In addition, through the courtesy of the commandant of the Pensacola Naval Air Station, an airplane dropped warnings over Caryville, Fla., on the afternoon of March 15, nearly two days before the arrival at that place of the crest of the flood.

Apalachicola system.—The rainfall distribution over the drainage area of the Apalachicola River was not so

M. W. R., March, 1929

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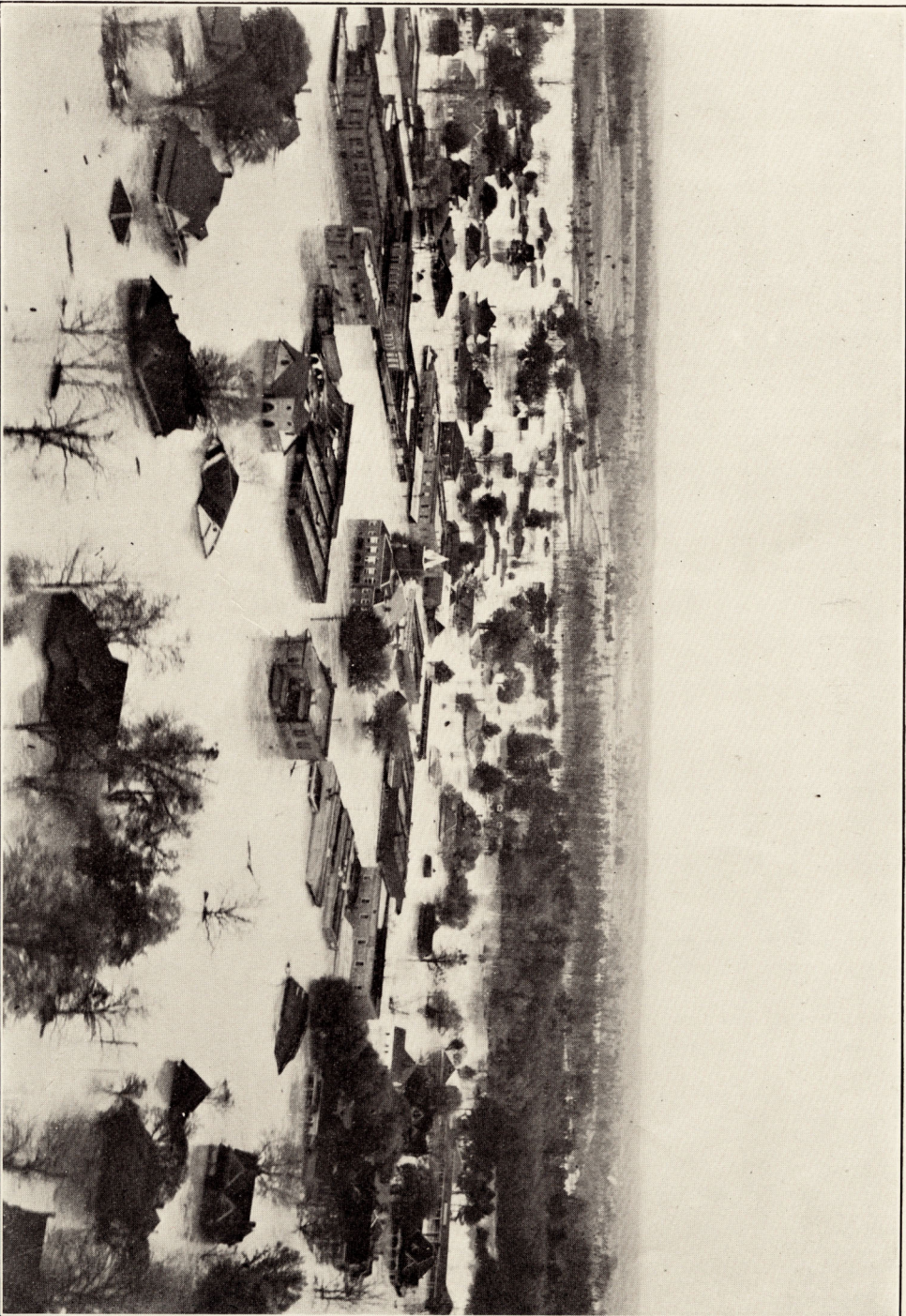


FIGURE 1.—An airplane view of the town of Elba, Ala., March 15, 1929. (Photo by Fourth Photo Section, Air Corps, Maxwell Field, Montgomery, Ala.)

uniform as over the rivers of southern Alabama. While the total fall over the Chattahoochee area was only 1 inch less than over Alabama, its distribution was more uniform, although its effects were much the same. Over the Flint River area, however, the average rainfall was nearly 6 inches less than over the Chattahoochee area, and over the Apalachicola area proper, about 17 inches less. Accordingly the Flint River flood crests, except at Montezuma, Ga., were about 2 feet lower than during the great flood of January, 1925. The upper Chattahoochee crests approximated those of January, 1925, while the lower Chattahoochee reached the highest stages of record, pouring down an enormous volume of water which, when united with that from the Flint River, raised the Apalachicola River from 1 to 2 feet above previous high stages of January, 1925, notwithstanding the fact that the direct precipitation over its basin was relatively small.

Each of the four periods of heavy rain before mentioned was followed by flood conditions and with the maximum effect from the third period. The first warnings were issued on February 26 during the first rain period, and thereafter as regularly and frequently as required. Despite the complexity of conditions caused by the succession of heavy rains, the warnings, always timely, were very accurate, and in the Apalachicola Basin proper, where much more territory was inundated than in January, 1925, it is doubtful whether the damage and loss were as great, owing to the emphatic character of the warnings and the precautions taken in consequence. As early as 9 a. m., March 15, five and six days in advance of the crests, warnings were issued for the most dangerous flood in the history of the Apalachicola River.

During the floods five lives were lost, three in Flint and two in Chattahoochee territory. There was also one drowning in the Willacoochee River near Fitzgerald, Ga. At West Point, Ga., on the Chattahoochee River, the Atlanta & West Point Railroad tracks were under water from 3 to 6 feet deep, and traffic was suspended for 48 hours. The entire downtown section, nearly all residential districts, and many square miles of surrounding farm lands were inundated, and traffic was conducted in skiffs and motor boats. The city of Eufaula, Ala., is safe from flood, but on the Georgia side of the river a few residences and some filling stations were overflowed. The city of Fort Gaines, Ga., south of Eufaula, underwent its first flood experience.

At Montezuma, Ga., on Flint River, many residences and stores were under water, and boats were used in the streets. The town of Newton, Ga., on Flint River, was covered, as it is always when the stage at Albany, Ga., exceeds 30 feet, but the inhabitants were notified by long-distance telephone to vacate the town on March 2 and again on March 17. Other towns below were also more or less flooded.

There were the usual delays due to washouts, bridge failures, and highway damage, as well as much inconvenience and interruption of business, but as a whole the loss and damage were surprisingly small, when the wide extent and great volume of flood waters are taken into account. Railroads and State roads suffered to the extent of about \$600,000, about equally divided; buildings, factories, etc., about \$100,000; cost of moving property, \$30,000; prospective crops, \$22,000; livestock and other movable property, \$18,000; and losses due to suspension of business, \$79,000; making a total of \$849,000. The reported value of property saved through warnings was in excess of \$300,000.

Altamaha system.—The average rainfall over the drainage areas of the Oconee and Ocmulgee Rivers of Georgia

for the four great rain periods was between 14 and 15 inches, about the same as over the Flint drainage to the westward. However, over the Altamaha Basin proper the rainfall was very much less, probably not over 6 inches, and very fortunately so, as any rainfall approximating that to the westward and northwestward would have caused throughout the Altamaha a flood exceeding that of January, 1925. As it happened, no records were exceeded throughout the entire basin, although at Dublin on the Oconee and at Hawkinsville and Abbeville on the Ocmulgee River, the differences were not large.

The useful warnings were issued regularly, and were the means of saving \$75,000 in livestock and \$145,000 in movable property.

Loss and damage totals aggregated about \$400,000, of which \$200,000 was to bridges and highways and \$40,000 to crops.

Alabama system.—The floods in the Alabama River system were the sequences of the same rainstorms that were responsible for other southern floods, and were very similar in character and destructiveness, although the flood heights were relatively not so great as in the Conecuh, Choctawhatchee, Chattahoochee, and Flint systems. The average rainfall over the Alabama Basin for the four principal rain periods was 17.6 inches, against 21 to more than 23 inches to the eastward. The greatest differences occurred during the third period from March 13 to 15, when the Alabama system rains were about 8 inches less than to the eastward.

It is unnecessary to recount the flood effects. They were about of the same magnitude as elsewhere in the South, and losses were proportionately great. Those reported were as follows: Tangible property \$1,583,933; matured crops, \$14,950; prospective crops (6,630 acres), \$32,585; livestock and other movable property, \$14,060; suspension of business, \$41,568; total, \$1,687,156.

Warnings were timely, frequent, and accurate. The problem of flood forecasting in this district is much complicated in that the operation of the gates at the power plants along the rivers frequently render it impossible to forecast definite river stages for more than 12 to 24 hours in advance. Nevertheless the warnings issued were of great utility, and the reported value of property saved thereby during these floods was \$1,230,472. The total reported saving in the State of Alabama, not recorded elsewhere, was somewhat in excess of \$2,000,000.

Numerous expressions of appreciation of services rendered by the Weather Bureau were received, and a single one will indicate the general character:

AMERICAN RED CROSS, FAMILY SERVICE,
Montgomery, Ala., April 3, 1929.

Mr. P. H. SMYTH,
Meteorologist, U. S. Weather Bureau,
Montgomery, Ala.

MY DEAR MR. SMYTH: The Montgomery County Chapter of the American Red Cross wishes to extend to you their thanks for your cooperation in the tremendous problems that faced us during our recent disaster. We fully appreciate the fact that without the service which you were able to render our efforts to relieve suffering would have been futile.

Very truly yours,

BOARD OF DIRECTORS,
MONTGOMERY COUNTY CHAPTER A. R. C.
By (Sig.) MABLE CULTER, Executive Secretary.

Tombigbee system.—The Tombigbee River at Demopolis, Ala., passed its flood stage of 39 feet on February 28, and did not fall below that point again on the decline until April 9, a period of 40 days. The Black Warrior River at Tuscaloosa, Ala., passed its flood stage of 46 feet on February 28 also, but it lapsed twice before rising to its highest crest of 62 feet on March 15, and again before

attaining the second great crest of 61.3 feet on March 24. It fell below the flood stage by the early morning of March 28, but continued above the flood mark along the lower reaches of the river until April 9.

The overflowed area extended along the Tombigbee River for a distance of 250 miles above its mouth, and the width of the inundated area varied from one-half to as much as 8 miles. The extreme upper Tombigbee was not in flood, but for a distance of about 100 miles below Columbus, Miss., there was moderate overflow. The Black Warrior overflowed for a distance of about 150 miles above its mouth as did also the Noxubee and other tributaries of the Tombigbee. In all about 450 square miles of land were overflowed. The usual warnings were issued promptly and were well verified. Reports of losses were very incomplete, but partial returns showed a total of \$583,700, of which \$293,100 were in tangible property, \$19,000 was in crops (4,000 acres); livestock, \$43,400; and suspension of business, \$228,200. Reported value of property saved through the warnings, \$760,000. One item for which no figures can be given was the loss of an immense quantity of oysters on the reefs in Mobile Bay from the great volume of fresh water from the Alabama and Tombigbee Rivers. On the other hand the floods were of distinct value to lumbermen who were able to float much lumber near the mouth of the Tombigbee River.

Pascagoula and Pearl systems of Mississippi.—The average rainfall for the four great rain periods in the Pascagoula and Pearl systems was about 13 inches and the story of the floods was a repetition in somewhat moderate form of what occurred to the eastward.

Losses were not excessive, considering the area involved, as the season was too early for large crop losses. The reported losses were \$200,900, of which \$118,400 were in tangible property, \$43,400 in crops, \$5,100 in livestock and other movable property, and \$34,000 from suspension of business. Reported value of property saved through flood warnings, \$49,500.

Ohio River system.—The flood in the Ohio River which began at Pittsburgh, Pa., during the closing days of February passed down the river in the usual manner, and until the mouth of the Green River of Kentucky was reached, the crest stages reached were but little above the flood stages. Below the mouth of Green River the crests were from 4 to as many as 9 feet above the flood stages, with a crest at Cairo, Ill., of 51.9 feet, 6.9 feet above the flood stage, on March 20. Another rise began at Cairo on March 28 and the river at Cairo did not again fall below the flood stage until April 22, and the report for that district will appear in the Monthly Weather Review for April, 1929. There were no losses of consequence and the usual warnings were issued at the proper time.

There were also numerous floods in the tributaries of the Ohio River, and those in the Cumberland and Tennessee Rivers may be classed as great floods. The same four general rain periods that caused the floods in the South Atlantic and East Gulf States were responsible for these floods, but as the total rainfall was much less, only the fourth rise reached the proportion of a flood.

Cumberland River.—The floods in the Cumberland River were caused by the third rain of the month, which was the heaviest of the four periods over this drainage basin. Over the Caney Fork area there were 10.31 inches of rain from 6:30 a. m., March 22 to 7 a. m., March 23, of which 5.10 inches fell from midnight to 3 a. m., March 23. This enormous fall was reflected on the gage at Carthage at the mouth of Caney Fork. The crest stage of 69.4 feet at Burnside, Ky., at 4:30 a. m.,

March 24, was only 0.1 foot below the record stage of January 29, 1918, while at Rock Island, Tenn., on Caney Fork, the crest of 38.8 feet, about 3:30 p. m. of March 23, was by far the highest stage ever measured at that place. The gage was washed away about 6:30 p. m. of the same date.

The flood at Nashville covered the low districts of the city from about Fifth Avenue South almost to Twelfth Avenue North, and also large areas of North and South Edgefield on the opposite side of the river. Business in some sections was paralyzed and eight street-car lines were out of commission for some time, yet the loss and damage were quite small considering the magnitude of the flood.

Six lives were lost along the Kentucky headwaters of the Cumberland River and hundreds of families were driven from their mountain homes.

The total reported loss and damage amounted to \$3,098,900, divided as follows: Tangible property, \$2-547,000; livestock and other movable property, \$108,250; matured crops, \$2,400; prospective crops, \$107,000, and business suspension, \$334,250. The reported value of property saved through the warnings was \$1,891,000.

According to Mr. Warren R. King, district engineer, United States Geological Survey, Chattanooga, Tenn., the discharge at Nashville was greater than that during the flood of two years ago, when the crest stage was 56.2 feet on January 1, whereas the crest of the flood of March, 1929, was only 50.9 feet. The flood waters from Caney Fork were the first to reach Nashville, the flood from the Kentucky headwaters following and holding the high stage at Nashville with another slow rise that continued several days.

Tennessee River drainage.—There were no floods in the Tennessee River proper above the mouth of Clinch River, but below they were general, although the flood stage of 21 feet was not quite reached at Decatur, Ala. As a rule crest stages ranged from 2 to 7.6 feet above the flood stages, the maximum at Rockwood, Tenn., the scene of the drowning of eight boy scouts who were trapped in their bungalow. At Chattanooga, Tenn., the crest stage was 38.7 feet, 5.7 feet above the flood stage, at 11:50 p. m., March 25. On the previous day the drift passing Chattanooga was the greatest in quantity and the most varied in character that had ever passed that place, consisting, as it did, of logs, oil drums, freight cars, houses, furniture, telephone poles, and what not.

Except in the Clinch River, tributary floods above Chattanooga were not important, with only a few thousand dollars damage along the Big Pigeon River.

The greatest tributary disaster occurred along the Emory River where 18 lives were lost and damage done to the amount of perhaps \$4,000,000, of which \$3,000,000 fell upon the city of Harriman, Tenn. At this place the Emory River reached a stage of 61.2 feet at 10:30 a. m., March 23 (District Engineer Warren R. King, U. S. Geological Survey), with a discharge of 153,000 second-feet, or one-third more than the discharge of the Tennessee River at Chattanooga during its greatest crest, that of 57.7 on March 11, 1867.

Other high tributary stages were 28 feet (estimated) in the Elk River at Fayetteville, Tenn., on March 23, exceeding the previous high record of the spring of 1920 by 4.5 feet and 43.8 feet in the Duck River at Columbia, Tenn., 1.8 feet below the record stage of March 30, 1902.

Losses and damage were not large below Florence, Ala.—only about \$77,000 reported—but they were very heavy above. The total given for the entire Tennessee River basin was \$4,863,665, almost entirely in tangible

property, highways, etc. Losses due to suspension of business amounted to \$101,665. Naturally very little planting had been done, and crop losses were only about \$6,000. The reported value of property saved through the flood warnings was \$1,224,000, mostly in Chattanooga and vicinity.

Other Ohio tributary floods.—All of the northward flowing tributaries of the Ohio River in the State of Kentucky were in flood to a greater or less extent. In the Levisa Fork of the Big Sandy River the crest stages on March 23 and 24 were not much below the highest stages of record, and at Pikeville, Ky., the river rose about 45 feet in about 33 hours, flooding more than one-half the houses in the town. Other towns were also flooded. No figures as to losses were obtainable except at Pikeville, where the total was placed at between \$100,000 and \$150,000.

The Kentucky River flood was most severe in the North Fork between Beattyville and Jackson and in the districts drained by the South and Middle Forks. There was no flood of consequence in the lower Kentucky River.

Loss and damage as reported amounted to about \$250,000, and were heaviest in Lee and Owsley Counties or the South Fork district. Two persons were drowned. The system of radio distribution of forecasts and warnings functioned excellently and certainly saved many lives and much property, as telegraph and telephone lines were disabled during the early hours of rising waters.

The Green River flood was moderate, and no material losses were reported.

The floods in the northern tributaries of the Ohio River were continuations of those of late February, and were given brief mention in the MONTHLY WEATHER REVIEW for that month. (The flood of late February in the Miami River of Ohio, report of which was postponed for this issue of the REVIEW, is discussed at the end of this report.)

Great Lakes drainage.—Warm weather during the last days of February and early March caused moderate floods in the St. Joseph River of Indiana and the Grand River of Michigan, with a second one about the middle of March, due to moderate rains. There was no damage of consequence except from the Grand River in the vicinity of Grand Rapids, Mich. Two parks were overflowed, and a number of cottages damaged by ice and water, a number of cottagers being driven into different quarters. The official in charge of the Weather Bureau office at Grand Rapids remarked as follows regarding this flood:

On account of the remarkable similarity that existed between conditions, as regards snow cover and precipitation during December and January last, and the corresponding period in 1903 and 1904, when a river stage of 20.4 was reached at Grand Rapids, the situation was watched very carefully. It is believed that the small amount of precipitation in February and the first two weeks of March this year, together with the almost ideal melting of snow cover and absence of ice jams during time river was in flood, prevented the occurrence of a marked flood at this station.

Atlantic drainage except the Altamaha River.—Moderate rains and high temperatures with melting snows caused moderate floods from March 17 to 19 in the Connecticut and Hudson River systems, and a second equally moderate one in the lower Connecticut between March 24 and 28.

Warnings were issued whenever possible, and reported losses were moderate.

There was a flood of marked proportions in the North Branch of the Susquehanna River above the Pennsylvania line, and a moderate one below, between March 14 and 18. On March 11 the average depth of snow remaining on the ground in the upper drainage basin was 4.6 inches

with a water content of about 1.25 inches. Moreover a number of low ice gorges had formed in February and were consolidated by low temperatures during the first two weeks of March. Then moderate rains and high temperatures brought about the floods which caused damage that would have been much greater had not dynamite been used to dislodge an ice gorge that threatened one of the bridges of Binghamton, N. Y., as well as the overflow of several thousand homes.

Loss and damage as reported amounted to about \$200,000, almost entirely to tangible property, while the estimated value of property saved through the warnings was \$50,000. The damage below Binghamton probably did not exceed \$10,000.

The rains of February 27 and 28 were followed by an unimportant flood below the mouth of the Rivanna River on March 1 and 2. Warnings were issued and damage was inconsequential.

With heavier rainfalls to the southward, the floods in North and South Carolina were more decided, the crest stages during the first 10 or 12 days of the month ranging from 4 to more than 18 feet above the flood stages, with the maximum excess in the Cape Fear River of North Carolina. As the rains during February and March were the heaviest since 1903, the floods were severe and prolonged; yet the resultant damage was not great. A number of highways were closed, but the principal loss was due to suspension of business and delay in planting crops. Tangible losses in North Carolina were about \$10,000, and losses due to business suspension \$25,000, a total of \$35,000, while the reported value of property saved through the warnings was \$40,000.

The floods were also severe in the Santee River and its confluent streams, the month opening with virtually all streams in flood. Losses as reported amounted to \$248,350, of which \$207,500 were mainly in small highway bridges and approaches and young crops in lowlands. Prospective crop losses were \$12,950, livestock and other movable property \$4,275, and business suspension, mainly in lumbermen's wages in the low country, \$22,125. Reported value of property saved through the warnings, \$63,312.

As the area covered by maximum precipitation was neared, the flood intensity of course increased, and the flood in the Savannah River, as measured by the crest of 38.7 feet on March 6 at Augusta, Ga., was about the same as on August 27, 1908, and only 1.7 feet below the greatest crest of 40.4 feet on August 17, 1928.

There was the usual rise for each of the four rain periods, although even with the heavy rains, the third and fourth were not serious. The average for the first period was 4.57 inches and for the second 4.42 inches.

The usual warnings were issued promptly, and the final forecast for a crest at Augusta on March 6 between 38 and 39 feet was well verified by the actual crest of 38.7 feet on that date.

Eight human lives were lost during the floods, and the reported loss and damage, all outside of Augusta, amounted to \$175,000, of which \$75,000 occurred across the river from Augusta, while the reported value of savings through the warnings was \$580,000.

Study of these Savannah River floods discloses some very interesting problems, and Mr. E. D. Emigh, the official in charge of the Weather Bureau office at Augusta, Ga., contributed the following relative thereto:

By the gradual elimination of other possibilities and arguments, it seems more and more likely that the washing out of the 4-foot flash boards at the Stevens Creek dam during the August, 1928, flood will be the ultimate explanation of the excessive rise and

unprecedented behavior of the river at that time. In the working out of future problems, therefore, it would seem to be wise to ignore the inconsistencies between rainfall and crest stage at that time and make use only of the valuable information based on the actual discharge values at the Augusta Locks dam and the effect of that volume of water at the gage.

A very useful chart has just been received from the Savannah River Electric Co., Mr. J. E. Parker, vice president, Birmingham, Ala., showing discharge curves of the Savannah River at Augusta, worked out by that organization from all available streamflow measurements to date. The following data are undoubtedly the most authentic obtainable at this time:

Year	Gage	C. F. S.	Remarks
1888-----	38.7	304,000	No levee.
1908-----	38.8	307,000	Do.
1912-----	36.8	231,000	Do.
1925-----	36.5	151,000	Levee and South Carolina approach.
1928-----	40.4	226,000	Do.
1929-----	37.2	162,000	Do.
1929-----	38.8	193,000	Do.
Equivalents with present conditions:			
1888-----	43.3	304,000	Levee planned by Corey, Dabney, and Wingfield to carry 400,000 c. f. s. 2 feet below top, with levees both sides, at stage 36.4 feet.
1908-----	43.5	307,000	
100 yr.-----	43.0	287,000	
1,000 yr.-----	46.2	378,000	
10,000 yr.-----	48.4	445,000	
	47.0	400,000	

Mississippi drainage.—At the close of March the Mississippi River was in flood from Muscatine, Iowa, to Baton Rouge, La., except at St. Louis, Mo., and reports thereon will appear after the floods subside.

As a result of high temperatures with consequent melting of a large quantity of snow, and ice movement, there was a moderate flood in the lower Wisconsin River from March 17 to 25, inclusive. Warnings were issued and there was no damage of consequence.

In other rivers of Wisconsin and northern Illinois, including the Fox, Kickapoo, Pecatonica, and Rock Rivers, the floods were much more severe and several cities were more or less inundated. As no river and flood service is maintained on these rivers, no very definite statistics are available as to their extent and amount of damage done, except that the following details were reported by the Weather Bureau observer at Moline Airport, Ill., pertaining to the Rock River rise: That the stage of 14.9 feet (caused by an ice gorge one-half mile below the gage immediately after the breakup of the ice) at Moline Bridge at 11:30 p. m. of March 11 was the highest recorded there since June 27, 1892; that about 30,000 acres were overflowed along the river during the flood; and that while no great damage was done in cities, the inundation of roads resulted in the temporary isolation of several small towns, and a number of summer camps and homes near the river were damaged or destroyed.

All interior rivers of the State of Iowa were in flood at some time during the month and it is regretted that lack of space forbids a detailed report thereof.

But little of the heavy snowfall of January and February had melted, and there was but little thawing until about the middle of the second week of March, after which time mild weather caused a rapid thaw to set in and by the middle of the third week there was little snow left. Conditions for flood causation were ideal, and, as a matter of fact, previous to the general floods ice gorges caused local floods for short intervals at many places in the southern portion of the State. All records for the interior rivers for the month of March were broken, and the Cedar and Nishnabotna Rivers exceeded all previous records. There were some local ice gorge floods in the Des Moines River above the city of Des Moines, but the timely use of dynamite prevented serious

damage. Below Des Moines the situation was serious and much damage was done.

The floods in the lower Des Moines and Cedar Rivers will be discussed in the next issue of the REVIEW.

The Illinois River remained in flood throughout the month with no prospect of early decline. The February floods caused some inconvenience but very little damage, but during March there was damage and loss to the amount of \$175,000, of which \$75,000 was to tangible property and \$100,000 to prospective crops (100,000 acres). Reported value of property saved through warnings, \$28,000.

The floods in the Grand River of Missouri were of rather decided character. The February floods were marked by persistent ice gorges, resulting in great inconvenience and many damaged roads. At Chillicothe, Mo., a gorge held from February 26 to March 10, inclusive. High water prevailed until shortly after the middle of the month, yet losses were very small, probably \$15,000 in tangible property, against an equivalent amount, mainly in livestock, saved through the flood warnings.

The outstanding feature in the Missouri Basin was the great ice gorge and resultant flood at and in the vicinity of Bismarck, N. Dak. The ice gorge formed at Huff, N. Dak., 14 miles downstream from Bismarck, about March 18 and lasted until March 29 when it gave way under the influence of sunshine and mild temperatures. The gorge extended for a distance of 30 miles, and while lowlands were covered as far back as Mandan, N. Dak., and portions of Bismarck and Mandan were inundated, it does not appear that much damage was done. The river at Bismarck reached a stage of 18.5 feet, 3.5 feet above the flood stage at 9 a. m., March 27, and the gorge probably broke on the following day.

There were also numerous ice gorges above Mandan, but without serious results. The gorge at Williston, N. Dak., moved out on March 24.

Perhaps the most destructive ice gorge of the season was in the Yellowstone River at Miles City, Mont., and in Tongue River which joins the Yellowstone at Miles City.

During a severely cold winter ice had formed in the rivers to a thickness of as much as 51 inches and more than the normal amount of snow had fallen during January and about the normal amount in February. Warm weather, 60°, and a warm rain came during March 5 and at 11:30 p. m. on that date the ice in Tongue River broke. In the Yellowstone River, however, the ice held firmly, and the Tongue River ice was forced entirely across the Yellowstone ice to a depth of 15 feet. Having no other outlet, the ice jammed in the channel of the Tongue until it extended upstream for a distance of 2½ miles with the ice resting on the mud of the river bed for the first three-quarters of a mile. By the evening of March 7 about one-half of Miles City was inundated with backwater flowing from manholes in the main business district. At 3 a. m., March 8, the Yellowstone ice gave way, but the Tongue River gorge persisted until 2 p. m., March 10. It had been frequently dynamited for several days.

The damage amounted to about \$50,000, mainly to homes and furnishings.

The Yellowstone River was also gorged at Glendive, Mont., some distance downstream from Miles City, around March 8, damming the water for a distance of 10 miles upstream, and gorges were reported at other places. Losses were small. Press reports indicated similar conditions with severe losses from a gorge and flood in the Big Horn River in the vicinity of Graybull, Wyo.

The snow melting and ice break-up caused pronounced rises in the James and Big Sioux Rivers of South Dakota and the Floyd River of Iowa, tributaries of the Missouri River. The resulting overflows were not serious, and little damage was done.

Other floods mentioned in the table following this report were unimportant and caused no damage.

Miami River flood in February, 1929.—This destructive rise, details of which were not available for publication in the February Review, resulted from the same general combination of rain, frozen ground, snow, high temperature, and ice that caused the other damaging floods in Ohio during February. The official in charge of the Weather Bureau office at Dayton, Ohio, states that in the Miami conservancy district the run-off amounted to 114 per cent, and caused river rises from 10 to 15 feet within 12 hours to stages unprecedented in the history of the flood-control project in that locality. Further details from this official's report follow:

The flood compares favorably in volume with the one of 1898, which is reputed to be the second greatest within the history of authentic flood records in this section. No unusual damage occurred at Sidney, Piqua, or Troy, and the Stillwater River was not as high as in previous years. Englewood Dam on the Stillwater had a stage of 46.9 feet, being 5 feet below the previous high mark. At Pleasant Hill there was some loss caused by the breaking and washing out of 200 feet of a farm levee.

Each of the conservancy dams functioned just as planned so that within the area of the flood-control scheme, the loss was relatively small, and was confined to water backing into sewers or storm sewers not being large enough to carry off the surplus, causing overflows in streets and cellars. However in the section from Auglaise County on the north to Hamilton County on the south, rural districts suffered considerable damage by flooding low lands, county roads, culverts, and bridges. In the upper sections floating ice was blamed to a considerable extent for blocking storm sewers; this condition also blocked culverts which at any rate were too small to care for the unusual rush of water coming from the surrounding hills. In many cases the roads acted as dams, the water finally flowing over them and making falls on the opposite side; the falls gradually ate backward through the roads and caused washouts.

The river stages were the highest in the down-river cities due to the heaviest rainfall being along the lower Twin Creek Valley.

At Hamilton the river rose 10 feet in the 5 hours from midnight the 25th to 5 a. m. the 26th, and the crest 17.4 feet is the highest of record at that point. In Peck's addition—outside the flood-prevention district—the flood left in its wake 200 flooded homes. It is estimated that 150 persons were taken from their homes by boats. In New Miami, a village north of Hamilton, reports state that 300 were made homeless by houses being submerged to depths ranging from 1 to 6 feet. At Middletown the damage in the city consisted mostly of that caused by flooded cellars and backwater in both the business and residential sections. Roads were destroyed and shut off a large rural district from communication with the larger centers. The village of Amanda on Seven Mile Creek suffered along this line. Factories, particularly paper mills, were closed down, and travel was suspended for several days on the main highways. At Moraine City, south of Dayton, manufacturing operations were suspended for two days because of high water backing into electric-power tunnels and flooding the power house.

At Dayton, a levee on the old abandoned canal broke down, flooding cellars and streets in the east section of the city; and on the northern side of the city approximately 100 feet of railroad roadbed was washed out.

The Little Miami River and its tributaries are reported to have risen to the highest points ever known by them. Yellow Springs, the seat of Antioch College, suffered a water shortage as the water-works pump was forced out of commission by rising waters of this stream.

Springfield was apparently hit the hardest of any section in the State. Buck Creek which runs thorough the city and empties into the Mad River at the western edge of the city, broke from its banks, and forced more than 200 persons in the valley to vacate homes, and did very heavy property damage, swamping low lands and flooding streets and roads. Fire and flood it is said claimed the greatest toll in the history of Springfield, by the greatest flood in years, and the property damage is expected to reach at least a million dollars. Transportation facilities were halted entirely, and all power had to be shut off. The water supply for domestic

purposes was curtailed when a main line connection from the plant broke, forcing factories to close operations. Pandemonium reigned when the water began causing short circuits which resulted in two fires in two of the large plants and in a number of homes while firemen and policemen were carrying on the rescue work. Boats kept for such a crises in a park were reached with great difficulty because the park was flooded and other boats had to be located in order to reach those in the park, and after the lights went out the rescuers were greatly hindered in their work. The situation was the most precarious on record until the late forenoon when the water began to recede. The highest stage of record, 15.1 feet, was observed at our gage on the Mad River below the city about 2 p. m.

No estimate of the total losses caused by the flood is available. As noted above, at a single station (Springfield) the property damage alone amounted to at least \$1,000,000; in addition to which, besides all other direct damage to highways, homes, business establishments etc., in other localities, practically every factory in the district was forced to close for a time, with a resultant heavy loss due to suspension of business.

[All dates in March unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC DRAINAGE					
	<i>Feet</i>			<i>Feet</i>	
Connecticut: Hartford, Conn.	16	17	19	17.2	18
Hudson:		24	27	18.9	25
Troy, N. Y.	15	15	17	18.0	17
Albany, N. Y.	12	15	17	13.6	16
Castleton, N. Y.	10	16	16	10.2	16
Mohawk: Schenectady, N. Y.	15	15	16	19.8	15
Sacandaga: Northville, N. Y.	17	17	17	18.0	17
Susquehanna:					
Oneonta, N. Y.	12	14	18	16.5	15
Bainbridge, N. Y.	11	15	18	17.9	16
Binghamton, N. Y.	14	15	17	17.7	16
Towanda, Pa.	16	16	17	16.8	16
Wilkes-Barre, Pa.	20	16	18	23.3	17
Chenango: Sherburne, N. Y.	8	14	17	9.9	14
James:					
Columbia, Va.	18	1	2	23.5	1
Richmond, Va.	10	1	2	11.8	1
Roanoke:					
Randolph, Va.	20	1	2	21.4	1
Weldon, N. C.	30	(1)	6	20.4	6
Tar:			9	39.5	1-3
Rocky Mount, N. C.	9	1	10	10.6	5
Tarboro, N. C.	18	3	13	24.3	7
Greenville, N. C.	14	3	14	18.6	9
Fishing Creek: Enfield, N. C.	15	8	8	15.0	8
Neuse:					
Neuse, N. C.	15	(1)	10	19.3	3
Smithfield, N. C.	14	(1)	12	21.5	7
Cape Fear:		17	18	14.0	17-18
Fayetteville, N. C.	35	(1)	9	53.3	2
Elizabethtown, N. C.	22	(1)	12	33.8	4
Haw: Moncure, N. C.	22	(1)	27	25.2	26
Feedee:		(1)	2	28.5	1
Cheraw, S. C.	27	(1)	3	38.5	1
		5	8	36.8	6
Mars Bluff, S. C.	17	16	17	29.4	16
Lynches Creek: Effingham, S. C.	14	24	25	30.0	25
Waccamaw: Conway, S. C.	7	(1)	12	25.4	5
Santee:		11	19	17.3	10
Rimini, S. C.	12			8.0	15-16
Ferguson, S. C.	12	(1)	(1)	25.3	9
Catawba: Catawba, S. C.	12	(1)	(1)	17.5	10
Wateree:		1	1	17.0	1
Camden, S. C.	24	5	2	16.5	6
		8	3	31.8	1
Malta, S. C.	14	3	3	31.2	6
		8	8	28.8	24
Congaree: Columbia, S. C.	15	(1)	2	14.0	3
		23	2	14.0	8
Broad: Blairs, S. C.	15	(1)	2	25.9	1
Saluda:		5	8	24.5	5
		23	25	16.6	23
		(1)	2	25.2	1
		5	7	23.7	6
		16	16	15.6	16
		24	24	16.4	24
Pelzer, S. C.	7	(1)	2	10.4	1
		5	7	11.0	5
		15	16	9.0	15
		23	23	7.0	23
Chappells, S. C.	14	(1)	9	23.6	6
		16	18	17.6	17
		22	26	16.7	22

1 Continued from last month.

2 Continued at end of month.

River and station	Flood stage	Above flood stages—dates		Crest		River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date			From—	To—	Stage	Date
ATLANTIC DRAINAGE—continued						GREAT LAKES DRAINAGE					
Savannah:	Feet			Feet		St. Joseph: Montpelier, Ohio.....	10	(1)	4	12.5	Feb. 28
Calhoun Falls, S. C.....	6	5	5	7.2	5	Saginaw: Saginaw, Mich.....	19	16	18	12.7	17
Augusta, Ga.....	32	(1)	5	37.2	1	Tittabawassee: Midland, Mich.....	18	17	18	19.4	18
Broad: Carlton, Ga.....	11	(1)	5	38.7	6	Grand:	15	15	15	18.2	15
Altamaha:				17.0	Feb. 28	Eaton Rapids, Mich.....	5	(1)	8	5.6	1
Charlotte, Ga.....	15	(1)	6	24.5	5	Grand Ledge, Mich.....	7	(1)	16	5.2	17-19
Doctortown, Ga.....	10	(1)	15	17.0	15	Grand Rapids, Mich.....	11	17	19	7.0	Feb. 28- Mar. 1
Everett City, Ga.....	10	(1)	22	14.5	22	Red Cedar:	6	19	10	13.9	7
Oconee:				35.7	Feb. 28	Williamston, Mich.....	6	(1)	2	7.1	1
Milledgeville, Ga.....	22	(1)	3	32.6	6	East Lansing, Mich.....	8	(1)	2	8.3	1
Dublin, Ga.....	22	(1)	15	29.6	16						
Ocmulgee:				23.4	24						
Macon, Ga.....	18	(1)	2	24.1	19						
Hawkinsville, Ga.....	29	(1)	5	25.8	Feb. 28						
Abbeville, Ga.....	11	(1)	8	24.9	6						
Lumber City, Ga.....	15	(1)	15	24.7	16						
				19.9	23						
				34.9	8						
				32.7	18						
				19.6	10						
				23.5	12						
WEST GULF DRAINAGE						MISSISSIPPI DRAINAGE					
Apalachicola:						Ohio:					
River Junction, Fla.....	20	(1)	1	35.0	20	Dam 25, Point Pleasant, W. Va.....	40	1	3	44.7	2
Blountstown, Fla.....	20	(1)	30	28.6	21	Point Pleasant, W. Va.....	40	8	8	40.8	8
Flint:						Dam 29, Normal, Ky.....	50	1	4	44.2	2
Montezuma, Ga.....	20	(1)	1	26.3	1	Portsmouth, Ohio.....	50	2	3	51.1	2
Albany, Ga.....	20	(1)	6	26.1	7	Dam 33, Maysville, Ky.....	48	2	4	51.9	3
Bainbridge, Ga.....	25	(1)	16	27.4	17	Dam 35, Oneonta, Ky.....	45	3	5	49.3	3
Chattahoochee:						Dam 36, Cold Spring, Ky.....	50	4	4	46.0	4
Norcross, Ga.....	16	(1)	1	20.3	1	Dam 38, Grant, Ky.....	52	3	5	52.7	4
West Point, Ga.....	20	(1)	5	22.4	6	Dam 41, Louisville, Ky.....	45	3	10	47.3	4-5
Columbus, Ga.....	20	(1)	15	26.0	15	Louisville, Ky.....	28	5	6	28.4	5
Eufula, Ala.....	40	(1)	10	52.8	16	Dam 44, Leavenworth, Ind.....	51	6	6	51.0	6
Alaga, Ala.....	30	(1)	15	57.5	7	Dam 45, Addison, Ky.....	50	4	12	53.0	6
Choctawhatchee:						Dam 48, Cypress, Ind.....	45	5	12	46.2	10
Newtown, Ala.....	24	(1)	9	36.0	15	Evansville, Ind.....	35	2	17	42.1	11
Geneva, Ala.....	23	(1)	15	46.1	16	Dam 49, Uniontown, Ky.....	40	8	15	41.4	11-12
Caryville, Fla.....	12	(1)	8	33.0	8	Shawneetown, Ill.....	35	3	19	43.8	11
Pea: Pera, Ala.....	32	(1)	14	46.0	15	Dam 50, Fords Ferry, Ky.....	35	3	20	44.7	12-13
Conecuh:						Dam 51, Golconda, Ill.....	38	6	19	42.1	12-13
River Falls, Ala.....	35	(1)	7	37.2	2	Paducah, Ky.....	43	9	20	45.0	14-15
Brewton, Ala.....	13	(1)	15	37.9	8	Dam 52, Brookport, Ill.....	43	9	20	44.9	14
Alabama:						Dam 53, Grand Chain, Ill.....	43	6	(2)	48.7	19-20
Montgomery, Ala.....	35	(1)	10	57.5	7	Cairo, Ill.....	45	7	(2)	51.9	20
Selma, Ala.....	35	(1)	30	50.4	7-8	Muskingum: McConnellsville, Ohio.....	22	(1)	2	25.6	Feb. 28
Etowah: Canton, Ga.....	11	(1)	5	13.5	5	Tuscarawas: Coshocton, Ohio.....	8	(1)	2	17.0	Feb. 27
Coosa:						Walhonding: Walhonding, Ohio.....	8	(1)	1	16.5	Feb. 26
Gadsden, Ala.....	22	(1)	16	22.3	7	Big Sandy, Levisa Fork:				9.0	27
Lock 4, Lincoln, Ala.....	17	(1)	15	21.7	16	Pikeville, Ky.....	35	23	24	47.6	23
Wetumpka, Ala.....	45	(1)	15	55.4	15	Prestonsburg, Ky.....	40	24	24	42.2	24
Tallapoosa: Milstead, Ala.....	40	(1)	15	50.9	15	Scioto:					
Cahaba: Centerville, Ala.....	25	(1)	22	32.5	14	Circleville, Ohio.....	10	(1)	1	18.4	Feb. 27
Tombigbee: Lock 4, Demopolis, Ala.....	39	(1)	23	27.5	23	Chillicothe, Ohio.....	16	(1)	1	26.5	Feb. 28
Black Warrior: Lock 10, Tuscaloosa, Ala.....	46	(1)	6	50.0	6	Kentucky:					
Pascagoula: Merrill, Miss.....	20	(1)	15	61.3	24	Hazard, Ky.....	20	23	23	23.5	23
Chickasawhay:						Beattyville, Ky.....	30	24	25	43.1	24
Enterprise, Miss.....	21	(1)	14	35.0	16	High Bridge, Ky.....	30	26	27	31.2	26
Shubuta, Miss.....	27	(1)	23	31.9	24	Green River:					
Leaf: Hattiesburg, Miss.....	19	(1)	16	21.5	17	Lock 6, Brownsville, Ky.....	30	(1)	2	32.6	Feb. 28
Pearl:						Lock 4, Woodbury, Ky.....	33	(1)	4	41.3	2
Edinburg, Miss.....	21	(1)	16	24.2	17	Lock 2, Rumsey, Ky.....	34	26	28	34.9	7-9
Jackson, Miss.....	20	(1)	15	32.2	24, 25	Wabash:					
Monticello, Miss.....	18	(1)	16	20.4	15	Covington, Ind.....	16	(1)	1	17.7	1
Columbia, Miss.....	18	(1)	21	22.0	17	Mount Carmel, Ill.....	16	1	10	19.8	6
West Pearl: Pearl River, La.....	13	(1)	24	16.3	17-18	White: Decker, Ind.....	18	1	9	21.1	6
						White, East Fork:					
						Seymour, Ind.....	10	(1)	1	14.3	Feb. 27
						Williams, Ind.....	10	1	5	15.9	2
						Shoals, Ind.....	20	2	6	26.1	4
						White, West Fork:					
						Elliston, Ind.....	19	(1)	2	21.7	1
						Edwardsport, Ind.....	15	(1)	4	17.8	1-2
						Cumberland:					
						Williamsburg, Ky.....	22	23	26	30.4	25
						Burnside, Ky.....	50	23	25	69.4	24
						Celina, Tenn.....	45	25	29	52.7	27
						Carthage, Tenn.....	40	24	(2)	55.6	25
						Nashville, Tenn.....	40	4	6	41.0	6
						Clarksville, Tenn.....	46	6	8	50.9	30-31
						Lock F, Eddyville, Ky.....	57	9	10	57.2	7
						New: New River, Tenn.....	25	31	(2)	53.8	31
						Caney Fork: Rock Island, Tenn.....		23	23	41.2	23
						Tennessee:				38.8	23
						Rockwood, Tenn.....	20	24	26	27.6	24
						Chattanooga, Tenn.....	33	24	27	38.7	26
						Bridgeport, Ala.....	24	25	28	26.5	26
						Widows Bar Dam, Ala.....	17	1	11	22.4	3
						Guntersville, Ala.....	31	15	19	21.1	17
						Florence, Ala.....	18	24	30	27.5	27
						Riverton, Ala.....	33	16	30	34.8	28
						Tennessee:					
						Savannah, Tenn.....	40	23	(2)	18.9	16-17
						Johnsonville, Tenn.....	31	23	(2)	22.8	25
						French Broad:				44.6	25-26
						Asheville, N. C.....	4	5	5	4.6	5
						Dandridge, Tenn.....	12	13	17	5.8	14
								24	24	12.3	24

1 Continued from last month.

2 Continued at end of month.

3 Estimated.

THE EFFECT OF WEATHER ON CROPS AND FARMING OPERATIONS, MARCH, 1929

By J. B. KINCER

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI DRAINAGE—continued					
	<i>Feet</i>			<i>Feet</i>	
Big Pigeon: Newport, Tenn.....	6	{ 5 14 23	{ 6 14 23	9.8 6.5 8.5	5 14 23
Clinch:					
Clinton, Tenn.....	25	24	26	34.5	24
Kingston, Tenn.....	25	24	24	27.0	24
Elk: Fayetteville, Tenn.....	14	22	28	28.0	23
Duck: Columbia, Tenn.....	30			43.8	25
Hiwassee: Charleston, Tenn.....	22	24	24	22.6	24
Mississippi:					
Muscatine, Iowa.....	16	19	(¹)	16.7	23
Keokuk, Iowa.....	14	16	(¹)	19.4	23
Warsaw, Ill.....	17	16	(²)	22.0	23
Quincy, Ill.....	14	14	(²)	20.5	25
Hannibal, Mo.....	13	{ 2 14	{ 3 (¹)	13.8 20.4	3 25
Louisiana, Mo.....	12	{ 1 14	{ 4 (²)	13.7 18.4	3 19
Grafton, Ill.....	18	16	(²)	22.9	27
Alton, Ill.....	21	17	(²)	25.3	18
Chester, Ill.....	27	18	23	28.8	20
Cape Girardeau, Mo.....	30	18	(²)	34.1	20
New Madrid, Mo.....	34	6	(²)	41.0	21
Cottonwood Point, Mo.....	35	11	(²)	37.6	22-23
Memphis, Tenn.....	35	11	(²)	40.8	24-25
Helena, Ark.....	44	14	(²)	50.4	27
Arkansas City, Ark.....	48	18	(²)	53.4	31
Greenville, Miss.....	42	21	(²)	46.3	31
Vicksburg, Miss.....	45	21	(²)	49.6	31
Natchez, Miss.....	46	26	(²)	48.5	31
Angola, La.....	45	31	(²)		
Baton Rouge, La.....	35	30	(²)	35.5	31
Wisconsin: Portage, Wis.....	17	24	25	17.5	24
Rock: Moline Bridge, Ill.....	11	5	(¹)	{ 14.9 13.4	11 20
Cedar: Cedar Rapids, Iowa.....	14	18	20	20.1	18
Des Moines:					
Boone, Iowa.....	20	16	17	20.9	17
Tracy, Iowa.....	15	12	22	18.3	16
Ottumwa, Iowa.....	10	14	24	14.5	17
Raccoon: Van Meter, Iowa.....	13	12	19	18.5	12
Illinois:					
Morris, Ill.....	13	{ 4 16 23	{ 4 20 23	13.2 17.6 13.3	4 17 23
Peru, Ill.....	14	(¹)	(²)	21.2	18-19
Henry, Ill.....	10	(¹)	(²)	16.0	20-21
Peoria, Ill.....	18	(¹)	(²)	22.5	20-22
Havana, Ill.....	14	(¹)	(²)	19.4	23-24
Beardstown, Ill.....	14	(¹)	(²)	20.9	22-25
Pearl, Ill.....	12	3	(²)	19.6	27-28
Meramec:					
Pacific, Mo.....	11	18	19	13.7	19
Valley Park, Mo.....	14	19	19	14.3	19
Bourbeuse: Union, Mo.....	12	18	18	13.8	18
St. Francis:					
St. Francis, Ark.....	17	{ (¹) 18	14 27	21.8 20.4	3-4 22
Marked Tree, Ark.....	17	16	18	17.0	16-18
Missouri:					
Bismarck, N. Dak.....	15	27	28	18.5	27
St. Charles, Mo.....	25	17	19	26.4	17
Big Sioux: Akron, Iowa.....	12	14	15	17.8	15
Grand:					
Gallatin, Mo.....	20	{ (¹) 5	1 9	25.3 27.8	Feb. 28 8
Chillicothe, Mo.....	18	{ (¹) 13	11 17	26.4 22.4	Feb. 28 14
Brunswick, Mo.....	12	16	16	12.2	16
Arkansas: Yancopin, Ark.....	29	6	(²)	38.9	30-31
Petit Jean: Danville, Ark.....	20	(¹)	2	23.0	Feb. 27
White River:					
Georgetown, Ark.....	22	4	10	22.8	6-7
DeValls Bluff, Ark.....	24	8	10	24.0	8-10
Black:					
Corning, Ark.....	11	(¹)	27	13.4	1-2
Black Rock, Ark.....	14	(¹)	22	19.7	5
Cache: Patterson, Ark.....	9	3	18	10.1	6-7
YAZOO BASIN					
Yazoo: Yazoo City, Miss.....	25	23	(²)	26.1	31
Tallahatchie: Swan Lake, Miss.....	25	4	(²)	31.7	29-31
Sulphur:					
Ringo Crossing, Tex.....	20	13	14	20.5	14
Finley, Tex.....	24	2	6	25.3	3
PACIFIC DRAINAGE					
Willamette: Harrisburg, Oreg.....	10	22	22	10.5	22

¹ Continued from last month.
² Continued at end of month.
³ Estimated.

⁴ Still rising at end of month.
⁵ Ice gorge.

General summary.—Weather conditions during the first decade were generally unfavorable for field work in most of the South, as wet soil hindered plowing and seeding. Some drying occurred in the eastern Cotton Belt toward the close of the period, but in the main parts of the belt it continued unfavorably wet, except in western sections, where fairly good progress in field work was made. In the interior valleys little work was possible, due to frozen ground or wet soil, but the milder weather in western grazing sections was a great relief for livestock from the previous severe conditions.

During the second decade disastrous floods occurred in the Southeastern States, notably in parts of Georgia, southern Alabama, and some adjoining sections. Much damage by washing and flooding was done, and quite generally in the eastern Cotton Belt rains and wet soil further retarded field operations, with many early prepared fields in parts of the Southeast washed out. Abnormally warm weather in the northern States caused the snow cover to disappear rapidly, while in the Great Plains the soil dried quickly with conditions favorable for field work, although very little had been accomplished in the more northern States. Conditions were mostly favorable for livestock interests in the West, while the rains of the previous decade improved pastures and ranges in California.

The summerlike conditions that prevailed during the last decade in the eastern half of the country caused vegetation to advance rapidly, with early fruit trees blooming as far north as Kentucky and eastern Maryland, and buds swelling in some more northern portions. There was very little improvement in the Southeast, however, for although the temperatures were high and the latter part of the period fair, the soil continued too wet. In more western parts of the Cotton Belt outdoor work made better advance, with corn seeding progressing to southern Oklahoma, but the planting of cotton was still confined to extreme southern Texas and locally in Louisiana.

Small grains.—Winter wheat needed warmth during the first decade in the southern Great Plains, but weather conditions were mostly favorable, except in western Kansas and southwestern Nebraska, where it was too dry. There was some unfavorable thawing and freezing in the eastern belt and some reports of winterkilling were received from the Middle Atlantic section. Wheat continued to look well in the far Northwest and rains in the Southwest were beneficial. With moderate to rather high temperatures during the second decade wheat fields greened up appreciably rather generally, with the entire wheat area cleared of snow and an abundance of moisture generally. Fair to good condition was reported from most places, except for some damage by drifting soil in the southwestern belt and some winterkilling in Pennsylvania; wheat was not doing well in parts of Washington. Growth was markedly stimulated during the last decade by high temperatures and moist soil in most of the principal producing areas. Rain was still needed in western Kansas, and moisture was also inadequate in the Pacific Northwest. Field work was inactive in the